STEP 4. ASSESSING BENEFITS, PROBLEMS, AND RISKS

The purpose of this step is to systematically examine the major uses and effects of the road system at the ranger District scale, including maintenance level 1 and 2 roads, to generate the information baseline against which the existing and future road systems can be compared. The main element of this step is to assess the various benefits, problems, and risks of the current road system. This is accomplished by responding to the questions from Forest Service-643, derived from a synthesis of the benefits, problems, and risks of the current road system, an assessment of the risks and benefits of entering any unroaded areas. Its primary purpose is to identify problems and aid in the assessment of the ability of the road system to meet forest plan objectives. The synthesis focuses on the issues identified as priorities in Step 3.

Ecosystem Functions and Processes (EF)

EF1: What ecological attributes, particularly those unique to the region, would be affected by roading of currently unroaded areas?

The ecosystem on the District is assumed to include cultural as well as natural resources. The density and variability of cultural resources in the Four Corners area is of regional significance. Unfragmented wildlife habitat and Wild and Scenic Rivers designations are unusual on the District, and are considered of District-wide significance.

Bancos Canyon and the surrounding area is the largest unroaded block (approximately 6,300 acres) on the District. This area is unique in the District, and significant in the Carson National Forest because it contains a high density of archaeological sites that represent early Pueblo through early Navajo populations. Sites include Pueblo and Navajo habitation sites, limited activity sites, and Navajo pueblitos. Forty-six percent of all components of recorded archaeological sites in the District are found in the Bancos Canyon area. This combination of cultures and high density of sites has resulted in the area being under consideration for nomination as an archaeological District to the National Register of Historic Places (NRHP) and of direct interest to the New Mexico SHPO. A road ran the entire length of Bancos Canyon until the early 1970s when it was closed due to poor conditions and high maintenance requirements. Two plugged and abandoned wells are located within Bancos Canyon. Piping and discontinuous gullies continue to cause severe soil erosion, which also damages the archaeological sites near the road. Six sites were plated over to protect exposed features from use of the road in the 1980s prior to a brief period of gas exploration in the canyon. The road cuts through a total of 15 sites and one additional site nearby is indirectly affected by erosion from the road. Since then, this road has been closed but is still in place. The road is characterized by two main soil map units that have severe limitations for road construction, one of which is known to have mass wasting through soil creep. There are currently no active gas wells in this area, although some are projected.

Reopening the Bancos Canyon Road would involve much more than just opening a gate and some grading. It is likely that parts of the road would have to be realigned to avoid eroded areas or reconstructed to stabilize the road surface. Reopening the road would be likely to result in destruction of the 15 sites known to be intersected by the road alignment, as well as another 10 sites situated within the ROW. Improved access may result in accelerated vandalism to the 28 known sites situated close to the road, in addition to possible damage to other, as yet unrecorded, sites in this area of high archaeological site density.

Bancos Canyon was determined to be eligible for inclusion into the National Wild and Scenic Rivers System in 1998 due to its free-flowing condition and its outstanding cultural, wildlife, and recreational values. Its cliffs are used by wintering bald eagles for roosts. The river corridor is a riparian area with the largest concentration of willows on the District, providing habitat for migratory birds and other wildlife. As a result of the Wild classification, there is a requirement that the river's free-flowing character and outstanding values be preserved. A consequence of additional road construction in the Bancos area, to serve new gas wells, is likely to be increased soil erosion due to the erosive character of the soils and additional disturbance to important archaeological and wildlife resources. The disturbance to wildlife resources would lead to direct habitat loss as well as indirect functional habitat loss for some species and habitat fragmentation. In addition, road construction would likely increase soil erosion beyond the relatively high rates now occurring. These impacts may change the character of Bancos Canyon enough to alter its eligibility for the Wild and Scenic Rivers System.

La Jara and Valencia Canyons are areas of low road density and are sensitive because they provide valuable wildlife habitat, primarily elk winter range and migration corridors. La Jara Canyon contains two Navajo pueblitos that are listed on the NRHP. La Jara Canyon's river classification is "Recreational" and is eligible for inclusion in the National Wild and Scenic Rivers System. Because it is very steep, it is unlikely that roads would be constructed there. It is possible for roads to be constructed in Valencia Canyon because its sides are not as steep. Wildlife habitat would be affected if new roads were constructed in the area.

EF2: To what degree do the presence, type, and location of roads increase the introduction and spread of exotic plant and animal species, insects, diseases, and parasites? What are the potential effects of such introductions to plant and animal species and ecosystem function in the area?

Roads increase the potential for the spread of exotic organisms. In the District, the organisms of concern are primarily noxious weeds and bark beetles. Bark beetles have increased in recent years due to drought conditions and are present in much of the firewood that is collected by the public. Road traffic directly contributes to the spread of weeds and insects by transporting seeds and plant materials across the District on the vehicles and equipment that are moved from one location to another. The public would have access to wood infected with bark beetles and take it out of the District with them or may spill an infected piece of wood along the roadside.

District staff have determined that weed infestations are primarily spread by truck traffic to service gas wells because most of the year-round traffic is related to gas development. Additional wells and roads would create a greater potential for infestations by increasing traffic and surface disturbance when opening up new areas.

A noxious weed inventory of the District was conducted in 1992. Seven species were identified including Russian knapweed (*Centaurea repend*), Canada thistle (*Cirsium arvense*), field bindweed (*Convolvulus arvensis*), Scotch thistle (*Onopordum acanthium*), plumeless thistle (*Carduus acanthoides*), bull thistle (*Cirsium vulgare*), and Wyeth lupine (*Lupinus wyethii*). The areas of weed infestation on the District have been located by legal descriptions and well locations, but trends and frequency have not been determined. Therefore, the degree of the introduction and spread of weeds cannot be established.

The introduction and spread of exotic plants and insects that damage native vegetation reduce the biodiversity of the District, making it less suitable wildlife habitat and affecting the overall character, function, and balance of the ecosystem. Noxious weeds decrease the available forage for cattle and the wild horses by competing with desirable plants.

The occurrence of non-native animals on the District is minimal. Dendrological pathogens, insects, and diseases exist on the District. There does not appear to be a connection with their occurrence and spread and the existing road network.

EF3: To what degree do the presence, type, and location of roads contribute to the control of insects, diseases, and parasites?

The road system provides easy access to most parts of the District enabling staff to inventory noxious weeds, insects, diseases, and parasites. Road access facilitates control efforts by enabling trucks to get to areas that would be otherwise difficult to reach.

EF4: How does the road system affect ecological disturbance regimes in the area?

According to a report published by The Wilderness Society (Weller et al. 2002), the "ecological footprint" of a road system created to serve gas well fields "is much larger than the physical infrastructure footprint." Roads affect much more than just the area directly disturbed by fragmenting wildlife habitat, affecting migration patterns, limiting the use of core areas away from roads, and interrupting breeding and survival of young, especially deer, elk, and migratory birds in the District. The answer to question TW1 provides detail on the amount of habitat fragmentation occurring on the District and its impact, especially on deer and elk.

The direct effects caused by high road density include the loss of forage, fragmentation of connected habitats, removal of cover, mortality from vehicular traffic, degradation of water quality through sedimentation from unpaved roads near drainages, and the interruption of life functions. These direct effects may be more pronounced in areas with more open vegetative cover, such as that occurring in the northern part of the District. Indirect effects include the facilitation of increased access by off-road vehicles, increased harassment of wildlife through greater human access, additional habitat conversion due to increased and easy access, increased noise, and invasions of non-native plants that compete and affect wildlife feed and cover (Weller et al. 2002). Heavily used roads generate traffic and noise that have been documented in other parts of the U.S. to affect deer and elk, and may also affect the wild horses in the northern part of the District. Monitoring is needed to ascertain the effects of the road network on wildlife populations in the District. The road system that reaches all parts of the District helps fire suppression activities by providing access to fire fighters and by acting as fuel breaks that limit the spread of wildfires. Controlled burns are easier to plan because crews can easily access the areas to monitor and manage these fires.

EF5: What are the adverse effects of noise caused by developing, using, and maintaining roads?

Large trucks and other vehicles that service the gas wells and compressor stations in the District generate vehicle noise. This noise increases during hunting season when hunters use the roads for access. The noise of construction equipment during road building and maintenance is temporary but can be significant in this otherwise remote District.

Noise may have the greatest effect on deer and elk on their wintering range because it adds stress during the period when their energy is at the lowest point. Noise also affects recreational users of the District, especially at campgrounds. The Buzzard Park and Cedar Springs Campgrounds have been described by staff as not as desirable as others due to road noise, especially during the primary hunting season from October to November. The large amount of traffic that services the oil and gas roads also has the potential to affect recreational campers and hunters that camp

outside of established campgrounds. The desirability of some sites is negatively affected by this road traffic.

Aquatic, Riparian Zone, and Water Quality (AQ)

AQ1: How and where does the road system modify the surface and subsurface hydrology of the area?

In general, the roads intercept surface water runoff flowing across the landscape and divert flow down the roads or into the road ditches. When surface water runoff flows down roads, it tends to follow vehicle wheel tracks or the road ditch on the side. In either case, concentrated flow over bare soil results in erosion and transportation of sediment in the surface water to drainageways.

The location of unpaved roads in the context of the watershed, especially those near drainageways, and road grade are the primary factors that affect peak flows to the streams. Diversion of surface water by roads can reduce peak flows into drainageways in some areas. In others, runoff on roads can increase peak flows because the water is less likely to infiltrate the compacted soils. Impacts on surface hydrology from roads are greatest where the density of roads is the highest. **Table 2** shows the road density in each 5th-level watershed, considering only those roads and land within the District boundary. It is clear that the greatest impacts from roads are currently in the southern portion of the District.

Table 2. Road Density by Watershed

Watershed	Existing Road Density (mi/mi^2)
Bancos	1.58
Campañero	2.60
Carracas	1.89
La Jara	2.07

Subsurface hydrology may be affected on a local scale by disruption of infiltration into the soil profile, and subsequent transport and release to stream channels in the form of surface channel flows. Groundwater recharge to the Unita-Animas aquifer generally occurs in the higher elevations along the margins of each watershed so regional impacts to groundwater quality due to the District's road system would not be expected to occur.

AQ2: How and where does the road system generate surface erosion?

In arid climates, such as in the District, one of the main contributors to surface erosion is unpaved roads. Erosion on roads depends on soil types, road surfacing, road grade, traffic volumes, and the effectiveness and spacing of drainage structures. As the road density increases, the amount of surface erosion and resulting sediment delivery to streams increases correspondingly. Erosion rates on the roads in the District average about 20 lbs./ft each year. The combination of road gradient and the length of that gradient is an important indicator of roads that are likely to generate the greatest erosion. Roads with steep grades and short slopes are less likely to have significant erosion than roads with lower gradients and long slope lengths. Forest Road has been identified by District staff as having a steep grade and accelerated erosion for approximately ¼ to ½ mile, although **Table B-1** shows a low risk rating for this road.

Most of the main roads on the District have culverts or turnouts spaced at intervals to divert the runoff from the road and onto the adjacent land, which result in a reduction of erosion on the road by limiting the length of surface water flows and by causing sediment to be deposited in areas with grass cover and gentle (less than 8 percent) slopes. Currently, culverts and other water control structures are spaced at a distance not closer than 800 feet. In the *Soil and Water Conservation Practices Handbook 2509.22* (Forest Service, Region 3), Standard 41.14 – Control of Road Drainage, states that water control measures should be properly spaced to be effective in minimizing erosion. **Table 3** lists the recommended spacing for different slopes and soil types that may be used as a guide for access roads. The longest distance recommended is 420 feet, compared to much longer spacings on steeper grades in the District, highlighting the fact that additional water control structures are needed.

Table 3. Culvert and Water Bar Spacing

Road Gradient (%)	Soil Type (feet)	
	Sand, Silt, Clay	Gravelly
2	250	420
3	240	390
4	230	380
5	220	350
6	200	340
8	180	310
10	160	270
12	130	230
14	100	190
16	70	160
18	50	120

Source: NRCS 2002.

Erosion at culvert outlets is minimized where they are located on flat slopes or in areas with high ground cover and established grasses. Rocks placed at the outlet to dissipate the energy of the discharged water also minimize erosion. However, erosion on adjacent slopes is sometimes increased by the force of water discharged from culverts, especially on steeper slopes, highly erodible soils, or where there is little vegetation.

Surface erosion is minimized on the roads that have been stabilized with sandstone. In many cases, however, the sandstone has been pulverized by heavy truck traffic from the gas wells, resulting in increased potential for erosion of the sand surface layer as the rock base is ground down.

Washouts occur mainly at stream and arroyo crossings when flows from the drainageways overtop the roads, especially on unimproved surfaces, even where there are culverts. Approximately 90 percent of the District contains soils that are highly erodible in their unvegetated state. Since all of the roads are unvegetated, there is a high potential for erosion from roads if mitigation measures are not used. The steeper roads (over 10 percent grade) and those with long distances between

culverts or turnouts generate the most surface erosion. The road segments with the highest calculated sediment yields are listed later in Table 7.

AQ3: How and where does the road system affect mass wasting?

The mass wasting identified on the District is largely caused by collapse of steep arroyo banks. There is also significant erosion that moves small headcuts back into existing roadways, caused by concentrations of surface water flows, mostly from steep nearby canyons. A recent project using roads committee money is attempting to remedy the safety hazards identified. Head cuts were filled and rip rapped and small ponds were created where feasible to slow down erosive water flows.

The Bancos Canyon Road erosion problem (described in the response to question AQ1) consists of piping that has developed into discontinuous gullies in places and mass wasting from soil creep.

The collapse of arroyo banks and erosion problems are identified problems on Forest Road 357 in Vigas Canyon and on Forest Road 314 where it parallels Carrizo and Ahogadero Canyons. The mass wasting occurring along Vigas Canyon is caused by high flows in the canyon eroding the vertical banks, at least 20 feet high, on the outside of a meander. The streambanks consist of sandy soils that erode easily, so the velocity of the flowing water has removed 20 to 30 feet of bank horizontally, exposing a gas pipeline that was buried in the bank and under the channel, and causing approximately 2 feet of the road to cave in above the stream. This is a safety problem for Forest Road 357, which is heavily traveled to access the wells in the southern part of the District. Other vertical arroyos have similar problems, but few are along roads.

AQ4: How and where do road-stream crossings influence local stream channels and water quality?

Road-stream or arroyo crossings have the potential to directly and indirectly affect local stream channels and water quality. Undersized culverts that cannot handle the quantity of surface water runoff from frequent storm events cause stormwater to back up and flow over the road surface, eroding the road and dumping sediment into the stream. In areas where the upstream watershed is highly erodible due to a lack of vegetation or erosive soils, culverts frequently become clogged with sedimentation, requiring frequent cleanings to avoid erosion of the road surface. Where there are no culverts installed, road traffic across fords loosens bare soil that erodes downstream when there is water in the channel.

All of these situations occur in many areas across the District. There is only one bridge on the District. All other crossings are either culverts or fords. All of these crossings connect areas of bare soil to the stream system, resulting in the delivery of sedimentation to streams and arroyos. Because there are no perennial streams on the District, it is likely that some of this sedimentation is deposited locally, while much of it has the potential to flow off the District and into the major streams during storm events or snowmelt periods.

AQ5: How and where does the road system create potential for pollutants, such as chemical spills, oils, de-icing salts, or herbicides, to enter surface waters?

The road system is most likely to create potential pollution hazards in surface waters where the roads cross or run adjacent to streams, wetlands, or stock tanks. No de-icing salts are used on the forest roads, but there are regular incidences of spills by vehicles serving the gas wells. According to District staff, trucks roll over 3 to 6 times per year and discharge produced water. Spills of produced water occur regularly and chemical spills occur occasionally, but most occur at well pads not on roads. Operators are required to report spills.

AQ6: How and where is the road system "hydrologically connected" to the stream system? How do the connections affect water quality and quantity (such as, the delivery of sediments and chemicals, thermal increases, elevated peak flows)?

As described in responses to questions AQ1 and AQ4, the road system is hydrologically connected to the stream system at every road-stream crossing. There are over 300 locations where a road crosses a drainageway and almost 600 road segments others located within 200 feet of a drainage. Because most of the roads are unsurfaced, surface water runoff from roads contributes a significant amount of sediment to the drainage system, negatively affecting water quality by depositing sediment and any chemicals on the road. Once in the drainage system, large runoff events would carry this sediment and other pollutants downstream into the rivers and Navajo Lake.

Roads intercept the flow of surface water runoff and sometimes groundwater flow from the slopes and soils above. If a road is oriented across the slope, it intercepts upstream flows and transports the water down the road to a water control structure or channel. Groundwater flows become surface water flows when intercepted by roads. Surface water sheet flow is converted to concentrated flow in a road ditch, wheel track, or water control structure when intercepted by a road. As water flows down unstabilized road surfaces or road ditches, it detaches and carries soil particles with it that get deposited in low points or drainageways. Roads that parallel drainageways divert surface water flows off the road and into the channel through water bars, turnouts, culverts, or other water control structures. Peak flows in drainageways can be increased by the construction of roads, especially on compacted, steep roads that decrease stormwater infiltration and speed up the time it takes for the runoff to reach a channel. A portion of Forest Road 314 along Carrizo Canyon and US Highway 64 along Vaqueros Canyon are examples of roads that directly intercept runoff from the hillsides above. The District has been trying to get funding to relocate approximately ½ mile of Forest Road 314 that crosses a low meadow area near Laguna Seca Reservoir, which gets deeply rutted when wet and needs to be relocated to a higher, drier site. In other cases, road surfacing with sandstone, stabilization of fords with stone surface material, or improved water control structures, properly spaced, can be used to minimize sedimentation in stream channels from roads.

AQ7: What downstream beneficial uses of water exist in the area? What changes in uses and demand are expected over time? How are they affected or put at risk by road-derived pollutants?

Beneficial uses of water for determination of water rights are defined by the New Mexico Constitution and administered by the State Engineer, and in general, are limited to use by agricultural, municipal, and industrial users. Livestock and wildlife benefit from surface water and groundwater flows on the District.

All watersheds in the District flow eventually into Navajo Lake, Largo Canyon, or Gobernador Canyon, and ultimately into the San Juan River. Both perennial water bodies, Navajo Lake and the San Juan River, contain sport fishery and are used for agricultural, municipal, and industrial uses. The lower San Juan River supports the endangered Colorado pikeminnow and razorback sucker.

Few changes in water uses are expected over time. The primary user of water in the District is the gas industry, which purchases water for drilling operations from the holders of water rights. This is expected to increase as well development increases, but the water is supplied from sources off the forest land. High erosion rates on unimproved roads, especially those near streams, have the potential to impair downstream water quality with sedimentation and are expected to increase as more roads are built.

AQ8: How and where does the road system affect wetlands?

Roads can affect wetlands by altering surface water flows. In a few locations, culverts or road construction have dammed surface water and created small wetlands. In at least one location, at the upper end of the Bancos Canyon Road (UD8-19), a small wetland is fed by surface water runoff from the road and contained water even in the middle of July 2002, a drought year. However, there are few wetlands on the District, so the road system has little impact on them in general.

AQ9: How does the road system alter physical channel dynamics, including isolation of floodplains; constraints on channel migration; and the movement of large wood, fine organic matter, and sediment?

Roads increase surface water runoff by decreasing the infiltration of water due to soil compaction and diversion of runoff that formerly flowed down the hillslope onto the roadway. This may alter physical channel dynamics by increasing the quantity of water that is delivered to stream channels.

The road system in a desert environment is a major contributor to sediment in streams, especially where the roads are unpaved, as in the District. As the density of unpaved roads increases, sediment yield increases.

Placing culverts under roads at stream crossings constrains surface water flows and, in some cases, lengthens the time of concentration of runoff during storms that exceed culvert capacity. This can also result in surface water backing up and flowing over the road, causing erosion of the road fill, if the culvert is too small for the amount of water at its upstream end.

Along Vigas Canyon (Forest Road 357), channel migration has resulted in erosion of the road that must be stabilized to improve road safety. Some work has been completed to temporarily stabilize the road at the channel edge, but rock riprap and other measures needed to further limit streambank erosion would constrain channel migration. Forest Road 314 that parallels Carrizon Canyon was stabilized in some sections in 2002 using Roads Committee funding, but additional work is needed to complete this project.

AQ10: How and where does the road system restrict the migration and movement of aquatic organisms? What aquatic species are affected and to what extent?

There are no perennial streams on the District and few, if any, aquatic organisms, so this question is not applicable.

AQ11: How does the road system affect shading, litterfall, and riparian plant communities?

In the few cases where roads create ponded areas, wetlands may be created. New road construction through the few riparian areas could remove valuable plant communities, but Forest Service policy would preclude road construction in riparian areas.

AQ12-AQ14: How and where does the road system contribute to fishing, poaching, or direct habitat loss for at-risk aquatic species? How and where does the road system facilitate the introduction of non-native aquatic species? To what extent does the road system overlap with areas of exceptionally high aquatic diversity or productivity, or areas containing rare or unique aquatic species or species of interest?

These questions are not applicable to this District.

Terrestrial Wildlife (TW)

TW1: What are the direct effects of the road system on terrestrial species habitat?

Roads have the potential to affect wildlife and their habitat by generating dust, noise, increased human activity, and habitat fragmentation. Most ecological effects of roads are negative to wildlife (Forman 2000).

Dust generated along roads can settle on plants and block photosynthesis, respiration, and transpiration, altering the plant community structure, particularly in plant communities like the District where lichens and mosses are common (Trombulak and Frissell 2000). Roads can prevent or hinder the movements of smaller wildlife species such as amphibians, reptiles, and small mammals (Trombulak and Frissell 2000; Gibbs 1998).

Song birds do not seem to be affected by the types of roads and levels of traffic on the District, as shown by long-term studies of the gray vireo (*Vireo vicinior*) on nearby BLM land have shown that this species is not affected by the road system (Reeves 1997).

Human activities along roads may disrupt nesting raptors. For this reason, management recommendations for northern goshawk (*Accipiter gentilis atricapillus*) nesting, post-fledging, and foraging habitats indicate that road densities and traffic should be kept at the lowest level possible (Reynolds et al. 1992). Other birds of prey such as the golden (*Aquila chrysaetos*) and bald eagles (*Haliaeetus leucocephalus*) may have reduced reproductive success near roads and prefer to nest away from roads (Trombulak and Frissell 2000).

The avoidance of roads by large species of mammals has been documented. Avoidance is defined "as lower than expected use of areas adjacent to development compared with use of areas further from development" (Dyer et al. 2001). This avoidance can result in the functional loss of habitat and reduced carrying capacity (Dyer et al. 2001, Rowland et al. 2000).

Studies have shown that the avoidance of roads by mule deer (*Odocoileus hemiionus*) and elk (*Cervus elaphus*) seems to be a widespread phenomenon (Rost and Bailey 1970, Lyon 1983, Rowland et al. 2000). Rost and Bailey (1979) found that deer and elk avoid roads ranging from interstate highways to gravel roads, particularly within 660 feet. Ward (1976) found that mule deer avoided habitat out to about 100 yards from a busy interstate highway but seemed little affected past that distance, even within full view of the highway. Hershey and Leege (1976) and Ward (1976) found reduced habitat use by elk within 0.25 mile (1,320 feet) of roads and that elk were more sensitive to road traffic than mule deer. Elk have been shown to prefer lower road density in their home range when compared with surrounding habitat (Jones 1997).

In some cases, mule deer and elk demonstrate habitat and seasonal patterns, such as greater avoidance of roads in open versus forested habitats (Rost and Bailey 1979). Unsworth et al. (1998) found that in the spring, elk use of open habitat increased in unroaded areas, while elk in roaded areas increased their use of closed canopy habitat. Avoidance of habitat along roads seems to be related the to level of traffic. In Oregon, the amount of elk habitat affected was greater in the summer than the fall possibly due to increased road traffic in the summer (Rowland et al. 2000). The level of secondary road vehicle use and road density causing elk avoidance of roads seems to be small, but there seem to be lower limits where road avoidance did not take place. Cole et al. (1997) determined that elk movements were reduced and survival was increased in areas of light forest road use (less than 4 vehicles per week). Edge et al. (1987) found that elk did not avoid roads in a study area where the roads were closed to the public with a traffic volume of less than one vehicle per day. Elk movements increased and survival was reduced at 1 to 2 vehicles per day

(Cole et al. 1997) and avoidance of habitat along roads was documented at 1 to 4 vehicles per day (Rowland et al. 2000).

Elk habitat use was apparently not affected at low road density (0.29 mile roads per sq. mi.), while at higher density (1.94 mile roads per sq. mi.) they tended to select areas away from roads (Unsworth et al. 1998). The Carson Forest Plan lists the limit on open road density as 0.5 mi/mi^2 for the Deer and Elk Winter Ranges in the Jicarilla Ranger District. Current open road density is 0.6 mi/mi^2 in the Deer Winter Range and 1.1 mi/mi^2 in the Elk Winter Range, both of which exceed the Forest Plan requirement. Consideration should be given to adding gates to achieve the established open road density limit or amending the Forest Plan if a new standard can be justified.

The road network fragments wildlife habitat by removing vegetation and segmenting areas used for food and cover. Habitat fragments are created when roads surround an area of wildlife habitat. Functional habitat loss occurs in the edges of these fragments, with reduced ungulate use of the areas closest to the roads, also called the road effects zone. Deer have been shown to avoid road effects zones within 660 feet of roads and elk reduce their use of areas within 1,320 feet of roads (Ward 1976). Relevant road effects zones on the District range between 660 feet to 1,320 feet from the road, especially where there are high traffic volumes. Approximately 66,000 acres or 42 percent of the District is within 660 feet of a road. Over 109,000 acres or 69 percent of the District is within 1,320 feet of a road.

Land not within these road effects zones provide secure habitat, especially during the hunting season (Millspaugh el al. 2000). For elk, this habitat should be a contiguous area of at least 250 acres and at least ½ mile from a road. There are approximately 13 fragments (almost 7 percent of the District) that meet these criteria to provide secure elk habitat.

The effects of roads on ungulates depends on the following conditions:

- Distance of habitat from roads (less than 660 may result in negative effects)
- Road density (over 0.6 mi./sq. mi. may result in negative effects)
- Vehicle use levels (over 2 vehicles per day may have negative effects)
- Road distribution and management
- Surrounding habitat and terrain
- Season
- Sex and age of animals
- Hunter use

TW2: How does the road system facilitate human activities that affect habitat?

The road system in the District facilitates human activity in wildlife habitat. The major activities resulting in vehicle use of the roads are 1) activities associated with the oil and gas program, 2) recreation, and 3) administrative use by District personnel. In general, traffic associated with the oil and gas program consists of vehicles traversing the roads to reach wells and other facilities. Few of these trips result in stops along the roads and fewer still result in individuals leaving their vehicles. Depending on the volume, traffic can affect wildlife as summarized in the response to question TW1.

The major recreational activity on the District is hunting. The high density of roads facilitates access to wildlife habitat for hunters. Traffic volumes increase on open roads in the District by 33 to 50 percent, resulting in effects on wildlife such as increasing game movements and limiting habitat use to the most secure areas.

District administrative traffic along the forest roads generally has little negative effect on habitat use due to the low volumes and staff efforts to establish road closure, monitoring, and correcting unauthorized use of existing roads and unauthorized off-road use.

TW3: How does the road system affect legal and illegal human activities (including trapping, hunting, poaching, harassment, road kill, or illegal kill levels)? What are the effects on wildlife species?

Greater road density increases access by hunters and poachers. In Oregon, Stussy et al. (1994) determined that 44 percent of elk mortality was from poaching and that three times more elk were taken by poachers than hunters. In another Oregon study where there is an extensive forest road network, poaching was the leading cause of known mortality of Roosevelt elk. When 35 percent of the study site had limited vehicle traffic (less than 4 vehicles per week), poaching was reduced to zero and contributed to higher survival rates of elk. When these roads were opened again to the general public, poaching began again (Cole et al. 1997). According to a New Mexico Department of Game and Fish (NMDGF) officer, hunters tend to be opportunistic and are more likely to illegally hunt game if they can drive to an area. Therefore, there is a correlation between open roads and the amount of poaching that goes on in an area (Reidinger 2003).

Dispersed recreation on the District is at low levels so traffic along the roads in the pursuit of these activities has little effect on wildlife.

TW4: How does the road system directly affect unique communities or special features in the area?

Unique areas on the District containing sensitive species habitat, including:

- Mexican spotted owl Protected Activity Centers
- Northern goshawk territory
- Wintering bald eagle nocturnal roost sites

The primary Mexican spotted owl habitat and bald eagle winter nocturnal roost habitat are in the steep ponderosa pine and mixed conifer dominated canyons. These areas have few roads due to the steep terrain, so sensitive species are not greatly affected. Road development in the one active goshawk territory on the District is kept to a minimum by Forest Service policy, and it assumed that current vehicle use is having little effect on this species.

Other unique areas include the Bancos, La Jara, and Valencia Canyons because they are essentially unroaded with important wildlife habitat and some riparian areas. The riparian areas typically occur as linear strips in canyons along some of the intermittent streams on the forest. In general, these areas are in steep canyons with limited access so vehicle activity along roads is having little effect.

Economics (EC)

EC1: How does the road system affect the agency's direct costs and revenues? What, if any, changes in the road system will increase net revenue to the agency by reducing cost, increasing revenue, or both?

The District has an extensive network of roads primarily due to oil and gas development. The extractive industries desire and have some rights to access on public land for exploration and production of resources. To the extent possible, existing forest roads are used, but new roads are built to provide access to specific well sites. The Forest Service balances access needs with

environmental and other resource values when permitting new roads. Also considered are the costs for maintaining the road network.

A detailed financial efficiency analysis would consider whether a program generates more revenue than it consumes. In the District, the majority of road maintenance costs are born by the oil and gas operators; therefore costs to the agency are relatively minor. A Roads Maintenance Committee comprised of current oil and gas permittees is responsible for awarding an annual road maintenance contract for major Forest Service roads on the District. The contract covers both annual operating costs and deferred maintenance costs. Forest Service standards apply for all road construction and maintenance. An amendment to the Roads Committee Bylaws in 1992, limits total annual maintenance costs paid by the committee to $200,000, but current annual allocations are $90,000. Both member votes and costs are allocated relative to the percentage of total producing wells operated by each member. In addition, industry operators incur costs for maintaining their lease roads. Expenditures by operators range from about $500/year for a minor operator to $164,000/year for a major operator.

District budgets for roads has varied considerably in the past. In most years, the funding is minimal with several thousand dollars provided for a few signs and incidental maintenance. The Forest Service has occasionally provided some funding for obtaining sandstone from pits on the District with matching funds from the Roads committee.

Construction and maintenance of new oil and gas lease roads to serve new wells would be borne by industry and would not impact direct and indirect costs and revenues to the agency. However, the agency does bear costs in permitting new roads.

EC2: How does the road system affect the priced and non-priced consequences included in economic efficiency analysis used to assess net benefits to society?

The existing road network provides excellent access to most of the District. The cost of this system are borne primarily by the oil and gas permittees, yet benefits access for a range of other uses, such as recreation and hunting, use and gathering of special products, and Forest Service administrative and monitoring uses. The negative costs of this system are the environmental effects on soils and habitats, displacement of other uses (such as grazing land), noise from oil field operations, visual impacts and declines in unroaded areas.

The road system supports a vital industry that provided benefits to both state and local budgets, but federal revenues as well. In fiscal year 2001, the Mineral Management Audit report indicated that producing leases on the District generated $20,160 in rents and bonuses, and over $20.4 million in royalties. In addition, about $20 million in taxes was also generated. While the agency does not benefit directly from the taxes and royalties collected from production, there are fiscal benefits to federal, state, and local government from these revenues.

EC3: How does the road system affect the distribution of benefits and costs among affected people?

The oil and gas industry is the primary user of the road network. They also provide the greatest monetary investment in maintaining and developing the system. During the fall hunting season, hunters increase traffic levels on many of the major roads in the District by as much as 50 percent. This user group benefits from the extensive network of open roads but the direct cost for road maintenance is not derived from recreational users. The extensive road network has indirect negative effects on users who prefer less intrusion of man-made infrastructure. Traffic and access can affect recreational users who seek more isolated experiences, and hunters can also be disturbed by traffic on roads that provide them superior access.

Commodity Production—Timber Management (TM)

TM1: How does road spacing and location affect logging system feasibility?

Not applicable to the Jicarilla Ranger District.

TM2-3: How does the road system affect managing the suitable timber base and other lands? How does the road system affect access to timber stands needing silvicultural treatment?

Not applicable to the Jicarilla Ranger District.

Commodity Production—Minerals Management (MM)

MM1: How does the road system affect access to locatable, leaseable, and salable minerals?

The primary minerals of concern on the District are leaseable minerals, specifically natural gas. Due to the regulations for well spacing and density, additional roads will be needed for infill drilling. Salable minerals, primarily sandstone, are used to surface some roads and ditches that are highly erodible or not well-suited to road construction. There are no known locatable minerals on the District and no operating plans. Salable minerals are limited to sandstone used to surface some roads and ditches and an occasional sale of sandstone for building stone.

Existing roads are not adequate to meet infill drilling needs, so the impacts of adding new roads will be analyzed in the EIS.

Commodity Production—Range Management (RM)

RM1: How does the road system affect access to range allotments and livestock management?

Similar to the effectiveness of the road system to provide access for timber management activities, the existing road network enables sufficient access to range allotments to manage livestock. However, the high number of roads constructed to access gas wells, in addition to the pipelines and well pads, result in lost productivity by taking forage out of production.

Traffic by employees for gas well and pipeline development and maintenance occasionally result in livestock being hit or scared. Other problems caused by the roads constructed to service the wells include locked gates left open, unsuccessful revegetation of disturbed areas after roads, wells, and pipelines are constructed, and the negative long-term loss of forage on closed roads that are not reclaimed, such as the Bancos Canyon Road. More roads on the District result in an increased potential for public access to range allotments, which sometimes results in damage to fencing and cattle guards, and more traffic.

Water Production (WP)

WP1: How does the road system affect access, constructing, maintaining, monitoring, and operating water diversions, impoundments, and distribution canals or pipes?

There are no water diversions or canals. There are 53 springs, 243 earthen stock tanks constructed to provide water to livestock, 2 windmills, and 18 guzzlers for wildlife within the

District. The road system provides access to facilitate construction and maintenance of these facilities.

WP2-3: How does road development and use affect water quality in municipal watersheds? How does the road system affect access to hydroelectric power generation?

These questions are not applicable to the District.

Special Forest Products (SP)

SP1: How does the road system affect access for collecting special forest products?

The current road system provides good access for collecting special forest products in the District. These include small Christmas trees, rocks, oak wood, and oak bows. Access to special forest products would be considered for 8.2 miles of roads identified for decommissioning under maintenance objectives.

Special-Use Permits (SU)

SU1: How does the road system affect managing special-use permit sites (concessionaires, communications sites, utility corridors, and so on)?

The District had a total of 47 special use permits issued as of June 2002. Of these, 21 were to outfitters and guides who make use of the forest primarily for leading hunting trips. Outfitters that are attracted to the District are ones that like the easy access provided by the road system. To have a roadless experience, guides have to go to other locations in the area and region.

Other special use permit categories include: fencing, experimental and demonstration, observatory, oil and gas pipeline, power line, state highway department Federal Land Policy and Management Act (FLPMA) permit, private mobile radio service, water pipeline for a church facility, NMDGF wildlife water supply, and U.S. Geological Survey stream gauging station.

General Public Transportation (GT)

GT1: How does the road system connect to public roads and provide primary access to communities?

Most access points into the District originate from U.S. Highway 64. Forest Roads originating from this highway include 357, 314, and 310. There are no communities directly served by forest roads. There are a few isolated private land holdings within the District, but the Forest Service does not hold easements on roads through private land. Although private land is entitled to access, it is not an objective of the District to provide or maintain access to private landowners.

Many roads continue to the east into the Jicarilla Apache Indian Reservation. Law enforcement efforts have not been able to curb access onto the Reservation that is reported to have resulted in poaching. In an effort to control this problem, the Jicarilla Apache Tribal Council passed a resolution to close certain roads not required to service oil and gas operations, and to provide locked gates on other roads that are required for oil and gas access.

Table 4 lists public roads identified as linking to the District to public roads and local communities.

Table 4. Public Roads under County, Tribal, or State Jurisdiction that Access the District

Public or Tribal Road	Forest Road
U.S. 64	357, 310, 314
State Highway 527, Rosa Road	308, 309, 311, 312
Indian Reservation Road 10	218, 310
Indian Reservation Road 10	301, 357
County Road 366	314

GT2: How does the road system connect large blocks of land in other ownership to public roads (ad hoc communities, subdivisions, inholdings, and so on)?

The forest road system provides access to inholdings, but providing access to private land and communities has not been a road network planning objective. Many of the smaller roads extend through the forest into Rio Arriba County and the Apache Indian Reservation. Some roads have been in existence and used by locals for generations, while most of the interstitial network of smaller roads and lease roads have been developed for the single purpose of providing access to well sites.

GT3: How does the road system affect managing roads with shared ownership or with limited jurisdiction? (RS 2477, cost-share, prescriptive rights, FLPMA easements, FRTA easements, DOT easements)?

There are no known RS-2477 roads and no FLPMA easements. Several roads cross from the forest into adjacent county and reservation areas. The major roads that extend beyond the forest boundary, 308, 218, 309, 311, 312, 314, 301, and 310, and in some cases, loop back onto the forest, such as 311, 357, are maintained by the Road Maintenance Committee. Lease roads are maintained by the well site operators. U.S. Highway 64 has an easement and is maintained by the New Mexico State Highway and Transportation Department. Due to problems with poaching thought to have been caused by access onto the Reservation, the Jicarilla Apache Tribal Council passed a resolution that closed certain forest roads that pass into Indian lands that are not required for oil and gas access. Some roads have been closed with lockable gates for those that do provide access for operators. When planning new roads or decommissioning, relationship to existing roads onto or connecting to roads on the reservation should be considered.

The Forest Service has no deeded easements through private property. There may be prescriptive rights established under applicable state law for sections of Forest Service roads through private property, but court action may be required to establish any prescriptive rights that may exist. Forest Roads 312, 310, 309, 315, and 357 could be closed by owners where they pass through private land, which could effectively cut off access onto and through much of the District.

GT4: How does the road system address the safety of road users?

The road system on the Jicarilla Ranger District is generally not subject to the Highway Safety Act. The road system was constructed to access the oil and gas field with very little engineering design, with a noticeable lack of curve widening and sight distance design. Main roads often have a surface that gets slick when wet and numerous culverts and drainage structures are needed. Funding allocated by the Roads Maintenance Committee has been used to repair road hazards

including the addition of some sandstone surfacing, installation of culverts, and grading or snow plowing to maintain surface conditions.

The Forest Service installs and maintains route markers and destination signs to aid in public travel. While conditions have improved markedly from the past, there is a lot of road work that is needed. When hazardous conditions are identified on specific roads, the District takes action to eliminate them. Most of the funding allocated by the Roads Maintenance Committee is used to repair road hazards, including the installation of culverts at stream or arroyo crossings, installing crushed sandstone to create a solid base on road segments that are unstable or soft in wet conditions, and grading roads to maintain surface conditions.

A major hazard reduction project on Forest Road 357 in Vigas Canyon and Forest Road 314 in Ahogadero and Carrizo Canyons has recently been completed. Canyon banks were stabilized using Roads Committee funding, but further work is required to ensure the stability of this heavily traveled road.

Administrative Use (AU)

AU1: How does the road system affect access needed for research, inventory, and monitoring?

The road network on the District provides ample access for any administrative action. Some roads that have been closed but not obliterated, for example Bancos Canyon Road, could be used for such actions as well. There are no ongoing research, monitoring, or inventory projects.

AU2: How does the road system affect investigative or enforcement activities?

The road network provides good access for enforcement efforts by Forest Service and NMDGF. However, because of high accessibility, it increases the amount of enforcement activity needed. Problems include unauthorized cross-country travel, gates left open, poaching of wildlife and trophies (such as animal horns). Jicarilla Apache Reservation also experiences poaching (and enforcement) problems, with many of the offenders finding access from forest roads that continue into the reservation lands.

Protection (PT)

PT1: How does the road system affect fuels management?

The extensive road system provides a means to access all parts of the District to conduct fuels management activities. It also functions as breaks for starting and stopping burn blocks during fuel reduction projects. Firewood removal helps to meet fuel reduction goals and is facilitated by the road system, which provides good access to the public.

PT2: How does the road system affect the capacity of the Forest Service and cooperators to suppress wildfires?

The extensive road network acts as a fuel break and provides access for fire-fighting, but can be confusing to those who are unfamiliar with the system when trying to navigate during a wildfire. For the most part, roads are well signed.

PT3: How does the road system affect risk to firefighters and to public safety?

The extensive road system provides benefits to firefighters by making access and escape routes available. However, visitors unfamiliar with the network and the naming system could get lost while trying to exit the area quickly.

PT4: How does the road system contribute to airborne dust emissions resulting in reduced visibility and human health concerns?

The extensive road network consisting of mostly unimproved roads with regular gas industry traffic contributes significant levels of dust to the air. With over 1,500 acres of bare ground on 464 miles of roads, many of which are located on soils that are highly erodible, there would be an effect on local and possibly regional air quality, especially when the climate is dry and windy, but the impacts to air quality are temporary. As noted in the response to question TW1, dust from roads settles on plants in the area and can interfere with photosynthesis and overall plant function. Reduced visibility from blowing dust creates a safety hazard to users and may contribute to health problems for users of the Forest and adjacent lands.

Recreation—Unroaded and Road-Related (UR, RR)

UR1, RR1: Is there now or will there be in the future excess supply or demand for roaded or unroaded recreation opportunities?

Based on District staff input, there is currently an excess supply of roaded recreation opportunity, compared to the recreation demand in the District. With an average road density of approximately 2 mi/mi^2 of road, there is more demand for unroaded areas than are available on the District. The unroaded supply is dwindling as more oil and gas lease roads are constructed. Planning for recreation opportunities has not been a priority for the District, largely because the area is not perceived as a destination for recreational users, other than for hunters. Both Middle Mesa and Bancos Mesa have lower road density, and the road through Bancos Canyon has been closed. Only one outfitter prefers and uses the Bancos area.

The existing Recreation Opportunity Spectrum (ROS) for the District is summarized in **Table 5**. It should be noted that the total acreage of these three categories is greater than the total acreage of the District due to overlapping boundaries, resulting in some acreage having two classifications. The Semi-Primitive Nonmotorized class is important for nonmotorized recreation in a predominantly unroaded context. All nonmotorized activities are allowed in these areas. Semi-Primitive Motorized (SPM) offers access on level 1 and 2 roads and no facilities in a backcountry setting. There are no restrictions on the type of vehicles that can use these roads, so they provide opportunities for recreational off-road travel, as well as access for both hunting and oil and gas operations. Because it is illegal to ride an off-road vehicle that is not street legal, such all-terrain vehicles (ATVs), on roads used by other vehicles, there is a need to designate roads and trails specifically or inclusively for this use throughout the District. Because many of the lease roads are gated and not open to the public, they are useable by hunters on foot or horseback, and can provide access to areas that have few people. However, noise from wellhead compressors can affect quietness in these areas. The Roaded Natural (RN) areas tend to have more of the arterial roads, although none of the District's roads meet the standards for passenger vehicle travel. These areas may still have qualities of naturalness that are conducive to sightseeing, but the area lacks distinctive scenery that would make this a dominant activity. The District has a slightly higher percentage of RN than the Carson National Forest as whole (USFS 1986), and slightly less Semi-Private Nonmotorized (SPNM).

Table 5. Recreation Opportunity Spectrum Classifications

ROS	Acres	% of District
Roaded Natural (RN)	74,711	46
Semi-Primitive Motorized (SPM)	85,032	52
Semi-Primitive Nonmotorized (SPNM)	4,027	2

Although the District has many roads, few are suitable for passenger cars and comfortable travel. Most users operate four-wheel drive trucks and Sports Utility Vehicles that are suitable for high clearance road travel. Also, ATVs are popular with hunters because they give access to areas where it is difficult to drive. Extensive access introduces vehicles that are suitable for off-road travel into most areas, and increases potential for cross-country travel in areas that are not permitted or suitable for this use. This contributes to conflicts between recreational users, particularly those who value access over solitude or quiet.

According to District staff, hunting is by far the most popular recreational activity on the District. Hunting accounts for an estimated 15,900 recreational visitor days (RVDs) per year. (An RVD represents one visitor for a 12-hour stay on the forest.) Developed facilities for camping, found only at Buzzard Park and Cottonwood campgrounds, receive about 1,600 RVDs per year (mostly by hunters). Another 800 RVDs are estimated for camping throughout the forest. Non-hunter day-use for recreation is estimated at about 900 RVDs per year.

Mountain biking is increasing in popularity in the region, but not so much in the District due to its isolation. However, closed lease roads (about 118 miles) provide opportunities for nonmotorized uses (mountain biking, hiking, and horseback riding) throughout the District.

UR2 and RR2: Is developing new roads into unroaded areas, decommissioning of existing roads, or changing the maintenance of existing roads causing changes in the quantity, quality, or type of unroaded (or roaded) recreation opportunities?

Developing new lease roads in the Bancos, La Jara, and Valencia Canyons, and Fierro Canyon and Mesa would result in further declines of unroaded opportunities that are already in short supply in the District. Closing roads with gates would not increase unroaded resources because these segments tend to be short connections from arterials to well heads. Decommissioning roads could augment the supply of unroaded area, but it is expected that new roads will develop at a faster rate than roads are obliterated. Only about 8 miles of road are currently identified for decommissioning as a maintenance objective.

The cost for operating and maintaining the road system will continue to be borne primarily by the oil and gas industry. This situation is not likely to change. Roads must be constructed and maintained to Forest Service standards. The primary objective in prioritizing operations and maintenance projects will continue to be user and public safety. Maintenance objectives include improving up to 82 miles (17 percent) of roadway to passenger vehicle service levels in the District. The cost for these deferred maintenance and capital improvements is not known, but may be unrealistic given the needs to maintain current standards for an extensive system. Annual projects generally only affect a small portion of roads. Roads most likely to be improved to these standards are those maintained by the Road Maintenance Committee. With a current cap on committee expenditures of $200,000 annually, improvement is most likely to be addressed only where there are specific safety or environmental concerns. For recreational users, this would mean

that the District will continue to be accessible and attractive to those who prefer a more rugged experience.

UR3, RR3: What are the effects of noise and other disturbances caused by developing, using, and maintaining roads on the quantity, quality and type of unroaded (and roaded) recreation opportunity?

Noise from traffic on roads can be bothersome, particularly from loud or unmuffled engines such as those on dirt bikes and ATVs. This is particularly true around campsites where more persons are affected and activities tend to concentrate. As more oil and gas roads are developed, there will be more access into areas that are currently unaffected by noise from these sources and routine oil and gas operations. Recreational vehicular noise sources tend to be seasonal (during September to December) when hunting increases traffic levels on District roads by about 40 to 50 percent. Noise from vehicles would add to the continual noise generated by wellhead compressors and compressor station sites.

There are adverse noise effects from both road traffic and oil and gas equipment on persons who are looking for natural and unroaded experiences. If more gates are closed, recreation may be funneled into certain areas, which may reduce the quality of isolation sought by some that is currently dispersed widely on the road network. However, nonmotorized activities such as mountain bike riding, horseback riding, and hiking, may benefit from reduced noise on closed roads.

UR4, RR4: Who participates in unroaded and roaded recreation in the areas affected by constructing, maintaining, and decommissioning roads?

The largest recreational user group in the District is hunters. They would benefit most from access afforded by new roads, but would also be affected negatively by increased noise and human activity from construction of new roads throughout the District. With the high density of roads, decommissioning some roads should have few detrimental effects on access. However, when proposing roads for obliteration or closure, affects on access to favorite hunting, camping, or viewing spots should be considered. Some hunters prefer quiet and remote locations

Current noise policy for industry established by BLM limits oil and gas-related noise sources to 48.6 decibels in noise sensitive areas. There are seven areas identified in the policy, including two campgrounds and Gasbuggy Nuclear Test site, and four wildlife areas. The current policy does not address noise from motorized vehicles. A particular problem with setting standards for decibel levels for vehicle engines would be enforcement.

Other recreational activities include horseback riding and hiking (either as a purpose in itself, or as part of the hunting experience, mountain bike riding, and other motorized recreational vehicle riding. Because of distance from population centers and availability of more diverse, challenging, or scenic areas for these activities in the region, these activities occur at low levels. The existing network of open and closed roads provides many pathways for these uses, but none are specially designated for one type of user or other. Because of incompatibilities between some of these activities, it is beneficial to provide some opportunities for separation of activities. This can be accomplished by designating some roads or trails for specific uses. The District has many closed roads that may be considered for specific uses, based on the qualities along the road or trail (such as diversity, length, relief, soil type, and vegetative cover).

UR5, RR5: What are these participants' attachments to the area, how strong are their feelings, and what are alternative opportunities and locations available?

Hunters typically hold strong attachment to the activity and opportunity for hunting. This area is particularly good for deer and elk hunting. Surrounding public land in the San Juan Basin, southern Colorado, and further east in north central New Mexico provides similar opportunities for big game hunting. Hunters come from both local communities and from larger, more distant metropolitan areas. The District is within Big Game Management Unit 2B and Elk Unit 7. Many more applicants apply for licenses than are issued, indicating demand for hunting. About 80 percent of licenses are issued to New Mexico residents.

Local residents have hunted and gathered other forest products on forest land for generations. These activities are woven into the life style of people in the area. To some degree, some of these activities provide an important supplement to families whose incomes are low.

UR6, RR6: How does the road system affect the Scenic Integrity? How is developing new roads, decommissioning of existing roads, or changing the maintenance of existing roads into unroaded areas affecting the Scenic Integrity?

Nearly all the landscape within the District is classified as Modification (148,910 acres, or 90 percent) due to a combination of visual quality, degree of existing modification, and visual sensitivity. The landscape includes a range of vegetative regimes, predominantly piñon-juniper forest, with some larger coniferous types in the south half. The terrain is mostly hilly without any distinctive relief or landforms. The high road density (2 mi/mi^2 of road) and presence of existing oil and gas wells and infrastructure (averaging over 3 well sites per square mile) have reduced qualities of naturalness overtime. A corridor of Retention (about 8,800 acres, or 5 percent) follows the U.S. 64 Highway corridor, where sensitivity to landscape is greater because more viewers are affected and exposed to the surrounding scenery. Special siting and contouring of new roads is needed in this area to minimize visual intrusion and noticeability. Other areas that would be sensitive to change from addition of roads are the areas with lower existing densities. These conditions are found in Bancos Canyon, Fierro Canyon and Mesa, and La Jara Canyon. Under existing management objectives, some modification is acceptable in these areas. These areas may warrant more protection through application of conditions for siting and on new infrastructure and well sites.

Passive-Use Value (PV)

PV1: Do areas planned for road constructing, closure, or decommissioning have unique physical or biological characteristics, such as unique natural features and threatened or endangered species?

As described under question EF1, the areas with few roads and significant cultural and biological resources are the areas that are planned for little or no additional road construction. This would include the Bancos, La Jara and Valencia Canyons, and Fierro Mesa and Canyon.

Bancos Canyon contains one of the highest density of recorded archaeological sites in the District and relatively undisturbed wildlife habitat that includes riparian vegetation. The existing road through the canyon has been closed, but should be obliterated and revegetated to reduce the high sediment yields from the erodible bare soils in and around the road. There are no plans to build new roads in the sensitive Bancos areas.

La Jara and Valencia Canyons, and Fierro Mesa and Canyon, also contain lower road density than the rest of the District, which offers non-motorized recreational opportunities and relatively undisturbed wildlife habitat in areas used for primary elk winter range and migration. Road, well pad, and pipeline construction would be limited in these areas to maintain their primitive nature.

PV2: Do areas planned for road construction, closure, or decommissioning have unique cultural, traditional, symbolic, sacred, spiritual, or religious significance?

All areas with archaeological sites can be considered to be of cultural and traditional significance. Many parts of the District supply traditional materials, such as oak leaves, that are gathered for ceremonial uses. The densest area of archaeological sites currently recorded is in Bancos Canyon, where no new road construction would be permitted and obliteration of the closed road is recommended.

There are many other parts of the District with significant cultural resources that could be affected by road construction. Impacts from road construction include surface and sub-surface disturbance of sites, increased public access that could result in site vandalism, isolation of a site from its surroundings, and the introduction of elements out of character with the site setting. No Traditional Cultural Properties have been documented by the Forest Service, but it is likely that some exist within the District boundaries that have not been identified by the many tribes in the region.

PV3: What, if any, groups of people (ethnic groups, subcultures, and so on) hold cultural, symbolic, spiritual, sacred, traditional, or religious values for areas planned for road entry or road closure?

The District is part of the Navajo homeland and contains sites and uses that are important to the Navajo people. None have been specifically identified. It is likely that the Utes and many pueblos have cultural values related to this area. The District contains many sites that are ancestral to the Pueblo Indians. Currently, the District and Carson National Forest consult with the Navajo, Southern Ute, Ute Mountain Ute, Jicarilla Apache, Comanche, Hopi, Zuni, Jemez, Taos, Picuris, San Juan, Pojoaque, Nambé, Tesuque, San Ildefonso and Santa Clara Indians due to their ties to the area.

PV4: Will constructing, closing, or decommissioning roads substantially affect passive-use value?

Passive–use value applies to non-market values (those with no direct dollar value). These may include resources that people appreciate without actually using them or intending to use them such as wilderness areas, special landscapes, or an endangered species, and those that people want to remain available for others (Gucinski et al. 2000). Methods to estimate non-market value have been developed but are either costly or difficult to validate.

On the District there are no wilderness or roadless areas, but there are areas that are relatively unroaded compared to the remainder of the District in Bancos Canyon and Bancos Mesa, La Jara Canyon, Valencia Canyon and Fierro Canyon and Mesa. Each of these canyons has either unique archaeological, cultural and/or wildlife values. Restricting or constraining new oil and gas development in these areas would preserve the passive-use value of these relatively remote and unspoiled areas, where the encroachment of oil and gas development in surrounding areas has been causing a slow decline in uninterrupted habitat and areas that are difficult to access. This would benefit wildlife, scenic value, and reduce the potential for vandalism of cultural sites. The

cost for this preservation would be equal to the market value of either lower levels of development or costs of using more expensive alternative technologies.

The Native American tribes have connections to the area to different degrees. These may be associated with particular uses, locations, or sacred qualities. If roads were constructed in Bancos Canyon, they would substantially affect passive-use values. Since many of the passive uses are undocumented, the extent of the impact is not known.

Ranchers, and to some degree recreational users, hold symbolic value to pursuing their use and interests on the Forest. Both hunting and relative freedom for the public to access the forest for a variety of activities is held as an important opportunity, realized or not, for many citizens.

Social Issues (SI)

SI1, SI2: What are people's perceived needs and values for roads? How does road management affect people's dependence on, need for, and desire for roads and access?

People in New Mexico, outside the large urban areas, are accustomed to driving longer distances to destinations, which tend to be far apart. Because driving is a normal part of daily life, the willingness to drive becomes less dependent on the uniqueness or quality of the resource. People often depend on using roads to access public lands for a range of activities and uses. Decisions about locating new forest roads or obliterating roads can affect people's access for activities related to their livelihood (such as ranching and hunter guiding), that provide them the quality of life that includes hunting, recreation, and enjoyment of nature and quiet surroundings. In some cases, roads provide access to their property and homes. Communities and forest managers are also dependent on roads for administrative purposes and services, such as emergency response, fire fighting, experimental or monitoring programs, and law enforcement activities.

Roads, however, are perceived by some recreationists as causing an intrusion into their enjoyment of nature and quiet, a factor that should be taken into account when making decisions regarding the construction of new roads. Controlling road density may be one way to balance the desires and needs of all forest users. If the District can develop an optimum road density level that would allow for adequate access while minimizing the negative effects on roads, this could be a valuable management tool.

When roads are poorly maintained, they become unpleasant or difficult to travel. This can affect access for routine cattle operations, recreation, emergency response, fire fighting, and other administrative functions in the forest. Some persons believe the forest road system has become over-developed in response to resource production, while others view the extensive network as beneficial to their experience or uses of the forest.

Consideration should be given to maintaining or improving roads that are most heavily used, have an existing unsafe condition to correct, provide access for multiple uses (rather than one), provide through-access, or access to private property and homes.

SI3: How does the road system affect access to paleontological, archaeological, and historical sites?

One effect of an extensive road system is easy public access to paleontological, archaeological, and historic sites. This often has a negative impact on these important resources due to the increased potential for unintentional damage and vandalism.

SI4: How does the road system affect cultural and traditional uses (such as plant gathering, and access to traditional and cultural sites) and American Indian treaty rights?

The District has little information on what types of land uses are important and what natural resources are gathered. Therefore, the staff does not know whether the resources on the District are unique. There are no treaty rights directly affected by this area. The road system provides access to all users, not just tribal users, which could be of concern to the tribes.

SI5: How are roads that constitute historic sites affected by road management?

While there are sites of national significance, such as Gas Buggy Nuclear Test Site and archaeological sites that are eligible for the NRHP, they would not be affected by road management, unless surface water were diverted off the road and onto these sites. Forest Service policy would limit damage to significant sites by road maintenance.

SI6: How is community social and economic health affected by road management (for example, lifestyles, businesses, tourism industry, infrastructure and maintenance)?

People in the region are accustomed to driving distances to specific areas for specific purposes. The forest road network has provided access historically and this access is part of the expected lifestyle for many residents. Many persons perceive that there is a proliferation of roads in the San Juan Basin, particularly due to the smaller segments of single purpose access roads to well sites. The extensive road network on the other hand, has provided both land managers and counties with access for administrative, law enforcement, and emergency response. Given the road density, some roads could be obliterated and not substantially change access to some areas. In selecting roads to obliterate, priority may be given to roads serving only one purpose, roads that are no longer used, that are unsafe, in poor condition and difficult to maintain, and roads providing access to sensitive resources.

Arterial roads and major access roads to the oil fields often have segments under different jurisdictions. County roads with heavy use by oil and gas operators can be burdensome to maintain, particularly because the traffic tends to be heavy vehicles that can cause extensive rutting in some circumstances. County road budgets are generally inadequate to keep up with maintenance needs of roads that unsuitable for the types of vehicles that use them. As road conditions decline, this makes it more difficult to use roads. Also, erosion and gullying can have indirect effects on surface water quality in the surrounding watersheds.

Compared to other major attractions in the area (such as Navajo Lake, Mesa Verde Cliff dwellings, and Chaco Culture National Historical Park), the District is not a major tourist destination. Hunting is the most popular recreational activity, and has a very defined season from September through December. Hunters come from throughout the state as well as out-of-state. While in the local area, spending by hunters has small-scale beneficial effects on the local economy. The nearest communities that would provide services that are sought by hunters are Bloomfield, Dulce, Farmington, and Aztec. Small communities (such as Gobernador) and roadside stalls may also benefit from traveler spending.

There are a small number of commercial outfitter businesses that like the access provided by the extensive road network, especially considering that the area remains quite remote and isolated. The extensive road network also provides an opportunity for a special hunt for disabled persons each year. Some special forest products have commercial value. The volume of these activities on the District is relatively small, based on the number of permits issued. The collecting of Christmas

trees and latilla-sized wood could provide supplemental income to some families in the local area. Other products such as oak branches has more cultural than monetary value.

SI7: What is the perceived social and economic dependency of a community on an unroaded area versus the value of that unroaded area for its intrinsic existence and symbolic values?

There have been no surveys or gathering of information specifically to assess the perceived social and economic values of unroaded areas in the District. However, community input for the development of BLM's Farmington Field Office found that many area residents understand that the oil and gas industry is the basis of the local economy. Despite its mercurial cycles of boom and bust, this industry provides relatively good-paying jobs and revenues to counties and school Districts derived from taxes and royalties. There is also general awareness that the landscape and habitat have changed over time from accumulated development since the 1950s. Many persons believe that there can be a balance between development and resource protection even if there is some cost to bear.

Preserving unroaded areas in the District would be important for those who place high value on preserving uninterrupted natural landscape in the face of its decline over the past century. The San Juan Citizen's Alliance represents interests for environmental protection through wise development.

Many ranchers have experienced reductions in grazing land within their allotments over time, and on occasion, cattle mortalities caused by poisoning from some by-products at particular well sites. These losses may represent small percentages in the local industry, but can challenge the viability of individual operations (particularly small operators) that have been stressed by other factors such as drought. The District lacks the highly valued wilderness or primitive resources that provide a societal-scale benefit, either economically or for other passive use values. However, greater issues of cumulative effects of oil and gas development in the San Juan Basin on the environment are being expressed more frequently. In a larger ecological framework, preserving any remaining unroaded areas is gaining in importance and as a perceived value for society and future generations.

SI8: How does road management affect wilderness attributes, including natural integrity, natural appearance, opportunities for solitude, and opportunities for primitive recreation?

There are no designated wilderness areas or areas categorized for primitive recreation under the ROS on the District. The areas that have been determined to be eligible for Wild and Scenic Rivers designation, described under question EF1, met the criteria partly due to their relatively unroaded character and opportunities for undeveloped recreation. Management decisions that change the character of these areas may change their eligibility under the 1968 Wild and Scenic Rivers Act (PL90-542; USC§1271).

SI9: What are traditional uses of animal and plant species in the area of analysis?

Game animals are used traditionally for hunting and ceremonial uses. The District is within an important hunting unit that is managed by the NMDGF, primarily for deer and elk. Horns, antlers, and eagle feathers are collected for traditional ceremonies. Guides frequently take hunters on the District, and make use of the road system to facilitate their trips. Other traditional uses include oak leaf gathering and cattle grazing.

SI10: How does the road management system affect people's sense of place?

People's sense of place reflects attachments to an area arising from feelings about an area's special qualities. These may include the nature of the terrain, vegetation, presence of water, quality of light, enclosure or expansiveness, views and solitude, opportunities that make it a destination, familiarity, and connections to customary or long-term practices.

The road system allows access to places that hold these special qualities. The roadway itself can be part of the experience by providing comfort (or discomfort), a sense of journey, and enjoyment of attributes along the way. Changing the management of roads or developing new roads can alter the qualities that are essential to enjoying special places. For example, upgrading a road can increase the amount of users of an area, altering qualities of solitude. Down grading roads can make them difficult to drive, so that the area becomes inaccessible for users, or the experience of traveling becomes very uncomfortable. This is particularly an issue for elderly people.

The District is used primarily by oil and gas operators, but a range of other people use the road system and need to be considered in changing road management. Access or lack of access to areas that hold value for their cultural sites, sacred and traditional uses, scenery and vegetation should be considered.

Civil Rights and Environmental Justice (CR)

CR1: How does the road system, or its management, affect certain groups of people (minority, ethnic, cultural, racial, disabled, and low-income)?

The road system is available for use by all groups of people, therefore some changes may affect all groups similarly. Particular issues for the District relate to its location relative to several tribal groups and the high proportion of minorities and low-income persons in the area. **Table 6** shows that Rio Arriba County has a disproportionately high percentage of Hispanic persons. Both Rio Arriba and San Juan Counties have higher percentages of American Indians than New Mexico or the U.S. as a whole. The forest has a range of values ranging from sacred and ancestral sites, and places for gathering traditional or sacred products. Road closures or down-scaling the maintenance level of roadways may affect access to important resources and locations for tribal and other minority and ethnic groups.

Table 6. Population Composition of Local Counties Compared to State and Nation

Location	White		Black		Asian		American Indian		Hispanic	
	Number	%	Number	%	Number	%	Number	%	Number	%
Rio Arriba County	23,314	56.6	124	0.3	41	0.1	5,725	13.9	30,028	72.9
San Juan County	60,087	52.8	455	0.4	341	0.3	41,993	36.9	17,070	15.0
New Mexico	1,215,123	66.8	34,562	1.9	20,010	1.1	173,809	9.5	765,818	42.1
U.S.	211,347,851	75.1	34,614,894	12.3	10,131,188	3.6	2,532,797	0.9	35,177,738	12.5

Source: US Census 2000.

Note: Percentage of population total over 100 percent because some Hispanics are also included as White and therefore are double-counted.

The Jicarilla Apache Reservation is adjacent to the forest, and several roads connect the two areas. It is perceived that declines in game populations have been caused by poaching, much being attributed to unlicensed hunters finding remote access from these roads. It is beyond the tribe's law enforcement capacity to effectively monitor access. The tribal council passed a resolution to close certain roads. Other roads that are needed for access to well sites have lockable gates. Future road management decisions about closures, new roads, and changes in maintenance should consider the need to both provide access and control access across this boundary.

Because of the extensive road network, the District has been able to hold an annual hunt for the disabled. This very special opportunity benefits disabled hunters.